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DSSD CENSUS 2000 PROCEDURES AND OPERATIONS MEMORANDUM SERIES R-3

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Subject: Accuracy and Coverage Evaluation (ACE) Survey:
     Block Cluster Sample Selection Specification

I. INTRODUCTION

This memorandum describes the selection of the initial block cluster sample for the ACE Survey. The plan is to select a national sample of 25,000 block clusters plus 5,000 small block clusters. This includes a separate sample of 355 block clusters for American Indians Reservations (AIR). An additional 480 block clusters will be selected for Puerto Rico. This sample will be provided to the Field Division for independent listing. The results from the independent listing will be used to select a reduced sample for ACE of approximately 300,000 housing units. Requirements and details of the ACE design are not known at this time. A separate operation will be specified in a future memorandum to reduce the number of ACE sample clusters.

This specification describes a two step sampling process. The first step is the selection of the initial block cluster sample. The second step is a subsample of the first-step cluster when the estimated listing workload is too high. This second step is a contingency plan. Since listing constraints are accounted for when calculating sampling parameters, expectations are low that this step of sampling will be needed.

Before the block clusters can be sampled for each state, the Universe File and Block Cluster Sampling Parameter File must be completed and approved. This procedure assumes that the stratification variables were assigned in the Universe File creation and the sampling parameters were calculated. These processes are specified in *"Accuracy and Coverage Evaluation (ACE)*

Survey: Universe File and Block Cluster Sampling Parameter File Specification." After the Decennial Statistical Studies Division (DSSD) reviews and approves the block cluster sample selection for each state then the sampled block clusters will be sent to the Geography (GEO) Division.

These specifications should be used to flowchart the process, to generate further discussion on requirements, to identify and finalize the record layouts of input and output files, and to write computer software to implement the methodology. During and after a testing phase, it is likely that changes to the specifications will be necessary.

The sections of this specification are ordered as follows:

- Section II states the assumptions and definitions of the sample selection process.
- Section III lists the input and output files for this process.
- Section IV lists the first-step sample selection process.
- Section V determines if second-step sampling is necessary.
- Section VI lists the second-step sample selection process.
- Section VII lists the sample selection output.
- Section VIII specifies the processes after the sample block clusters fields are updated by the GEO Division.

Any comments or questions should be directed to Thomas Mule (301) 457-8322 or James Farber (301)457-4282.

II   ASSSUMPTIONS/DEFINITIONS

A.   Block clusters have been created and verified for an entire state before sampling occurs in that state.

B.   Stratification is complete. Sampling strata are specified in *"Accuracy and Coverage Evaluation (ACE) Survey: Universe File and Block Cluster Sampling Parameter File Specification."*

C.   A target of 30,000 block clusters will be selected for the 50 states and the District of Columbia: 25,000 medium and large and 5,000 small. The allocation of the block clusters to the states is listed in Appendix I.

D.   The reduction of ACE sample clusters will be specified in a future memorandum.

E.   All numbers have been rounded to the sixth place after the decimal, xxxx.xxxxxx.

F.   Small block clusters have 0-2 housing units (HUs). Medium block clusters have between 3-79 HUs. Large block clusters have 80 HUs or more.

G. For each state, there are four possible sampling strata:

1) Small Block Clusters,
2) Medium Block Clusters,
3) Large Block Clusters,
4) American Indian Reservation (AIR) Block Clusters.

Note: The fourth stratum does not exist in all states.

H. Within each sampling stratum, the block clusters will be implicitly stratified. The implicit stratification for each state was determined by research done by the Sample Design Branch staff and applied during the stratification process.

I. The Estimated Listing workload resulting from selection for a state must be ten percent greater than the budgeted listing to require the second-step sampling.

III. FILES

The following files will be used in this process.

A. INPUT FILES

1. <u>Block Cluster Sampling Parameter File</u>: The first-step sampling parameters, e.g. Take-Every's and Random Starts, for each state will come from this file. There is one record for each sampling stratum in a state. Appendix A has a copy of the Block Cluster Sampling Parameter File layout that was originally specified in *"Accuracy and Coverage Evaluation (ACE) Survey: Universe File and Block Cluster Sampling Parameter File Specification."*

2. <u>Universe File</u>: Each state's Universe File was created during the universe creation process. There is a record for each block in every cluster. Necessary records and variables for sampling will be taken from this file. Appendix B has a copy of the Universe File layout that was originally specified in the *"Accuracy and Coverage Evaluation (ACE) Survey: Universe File and Block Cluster Sampling Parameter File Specification."*

3. <u>Sample Size Input File</u>: For each state, the budgeted number of housing unit listings has been determined. After sampling the estimated number of listings will be determined for each state. The estimated number will be compared to the budgeted number to make sure it is within our cost constraints. The DSSD will provide to the Decennial Systems and Contracts Management Office (DSCMO) the file, 2000_TB.FIN, which contains the budgeted counts. This is a state level file. These budgeted numbers for each are documented in Appendix I. The layout for this file is in Appendix H.

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4. <u>Sample Summary File</u>: The Sample Summary File has state-level summary statistics to track the sampling process. This file was created during the Universe File creation process. Estimates will be added to this file for each state. Appendix F has a copy of the file layout that was originally specified in *"Accuracy and Coverage Evaluation (ACE) Survey: Documentation for the Sample Summary File and Sample Design File."*

B. OUTPUT FILES

1. <u>Block Cluster Sampling Parameter File</u>: After sampling, the estimated number of housing units for listing will be calculated for each sampling stratum. This count will be appended to the Block Cluster Sampling Parameter File.

2. <u>Sample Design File</u>: The Sample Design File tracks the path that each sampled block cluster travels during the ACE sampling procedures. It is created after the first-step block cluster sample is selected and contains one record for each first-step sampled block cluster. The layout of the Sample Design File was originally specified in *"Accuracy and Coverage Evaluation (ACE) Survey: Documentation for the Sample Summary File and Sample Design File"* and is given again in Appendix C.

3. <u>Universe File</u>: After sampling, the Universe File will be updated to indicate if a block cluster was selected in the first or second step. The Index Numbers will be attached to the file so the sampling sort can be replicated.

   Note: For these specifications, if a block cluster is assigned a value on the Universe File, then all blocks in the cluster will receive the assigned value.

4. <u>ACE Stratification Summary File</u>: This file will contain summary sample estimates for each of the demographic/tenure groups in the sampling strata. This will provide summary information that can be used in determining the parameters for reducing the ACE sample cluster in the future. The layout for this file is in Appendix D.

5. <u>ACE Sample Cluster File</u>: This file will have a record for each block from a block cluster that remains in sample after the second step. This file will be sent to the GEO. The GEO will use this file to identify ACE sample blocks on the collection Geographic Reference File (GRF) and to create the ACE GRF. The layout for file that will be sent from the DSCMO to the GEO is in Appendix E.

6. <u>Field Prioritization File</u>: This file will have a record for each block cluster that remains in sample after the second step. This file will be sent to Field Division so

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they can prioritize their Housing Unit Follow-up (HUFU) and Person Follow-up (PFU) workloads. The layout for this file is in Appendix G.

7. Sample Summary File: The Sample Summary File has state-level summary statistics to track the sampling process. This file was created during the Universe File creation process. A second-step sampling indicator, the number of clusters in sample after each step and housing units to list estimates will be added to this file for each state. The layout for this file is in Appendix F.

IV. FIRST-STEP SAMPLE SELECTION PROCESS

A. OVERVIEW

The first-step sample selection process will select the initial ACE block cluster sample for each state. This process will obtain the sampling parameters for each sampling stratum from the Block Cluster Sampling Parameter File. An index number will be attached to each block cluster to identify the block clusters selected during the systematic sampling. An unique ID will be assigned to the sampled block clusters and the Sample Design File will be created. After sampling, the estimated listing workloads will be generated for each sampling stratum and recorded on the Block Cluster Sampling Parameter File. These workloads will be compared to the budgeted amount to determine if the second-step of sampling is needed.

Each state, the District of Columbia and Puerto Rico will be sampled separately. The process described below applies to each state's sample selection.

B. SELECTION PROCESS

1. Sort the Universe File

The Universe File will be sorted prior to sample selection. This sorting will reduce the variability of sample size among demographic/tenure groups and ensure a fair representation of block clusters across the counties in the state.

a. For each state, use the Universe File.

b.   Sort the block clusters in the following order:

- Sampling Stratum (SS)
- American Indian Country Indicator (AICIND)
- Demographic/Tenure Group (DTCODE)
- 1990 Estimated Urbanization (ECLUSURB)
- County (COUNTY)
- Geographic Block Cluster Number (GCLUST)

2.   **Attach First-Step Index Number to Each Block Cluster**

Number the block clusters consecutively from 1 to N within each sampling stratum where N is the number of block clusters in the stratum. The assigned number is referred to as the First-Step Index Number of the block cluster. Assign the First-Step Index Number (INDEX1) of each block cluster to the Universe File.

3.   **Select Sample**

For each of the sampling strata, select a separate systematic sample of block clusters as follows:

a.   Generate a sequence of numbers $L_1,...,L_n$ as follows:

- From the Block Cluster Sampling Parameter File, obtain the Random Start for Initial Block Cluster Sampling (RS1) and the Take -Every for Initial Block Cluster Sampling (TE1)

- Let $L_1 = RS1$

- Calculate $L_j = L_{j-1} + TE1$, for $j = 2$ to n
  where n is the largest integer such that
  $[RS + (n - 1) \times TE1] <= N$

- Round each L_j up to the nearest integer (an integer round to itself).

- For each block cluster in the sampling stratum:

    If the first-step index number is equal to the rounded values of L_j, $j = 1,...,n$ then do the following:

    ► Assign the First-Step Sample Indicator (BC1) on the Universe File equal to '1'. The block cluster was selected in sample.

    ► Assign the Current Sample Indicator (CSI) on the Universe File equal to '1'. The block cluster is currently in sample.

    Otherwise, do the following:

    ► Assign the First-Step Sample Indicator (BC1) on the Universe File equal to '0'. The block cluster was not selected in sample.

    ► Assign the Current Sample Indicator (CSI) on the Universe File equal to '0'. The block cluster was not selected so it is not currently in sample.

    For example: if N = 100, RS1 = 2.4 and TE1 = 7.2, then n = 14. Set $L_1 = 2.4$. The generated L_js would be the sequence: 2.4, 9.6, 16.8, 24.0,...,96.0. Therefore the block clusters with First-Step Index Numbers 3, 10, 17, 24, 32,..., and 96 would be selected for the sample.

b. Compute a Check

    For each sampling stratum, check the number of sampled block clusters, given by n, by calculating c, which is a check of the sampling procedures:

$$c = \left| \frac{N}{TE1} - n \right|$$

    If the sampling is implemented correctly, c will be less than 1. For values of c that are not less than one and have not been resolved, contact the DSSD for review of the sampling operations.

4. Number the Selected Sample Block Clusters

In each state, sort the selected block clusters by county and geography block cluster number. Number the block clusters selected for the first-step sample using the following algorithm.

The ACE block cluster sample number (CLUST) will be a five digit number. The first digit within the five-digit cluster number will represent the Census division. There are nine Census divisions. The remaining four digits in the five-digit cluster number will be a sequence number. Appendix J contains the range of cluster numbers allocated to each state within a division.

For each state, start with the lowest value in its allocated range of cluster numbers. Assign this to the first cluster in the sort. Increment the cluster number by one and assign it to the next cluster and so on. Do not assign cluster numbers to any block cluster that was not selected in the first step of sampling.

For example, Texas has a range of ACE cluster numbers between 54001 and 57999. Assign 54001 to the first cluster, 54002 to the second cluster, and so on.

Assign the check digit (DIGIT) for the ACE block cluster sample number. The DSCMO will use the Double-Add-Double Check-digit Algorithm to assign the check digit. Appendix K documents this algorithm.

5. Create the Sample Design File

The Sample Design File tracks the path that each sampled block cluster travels during the ACE sampling procedures. It is created after the first-step block cluster sample is selected and contains one record for each sampled block cluster.

The layout of the Sample Design File was originally specified in *"Census 2000 Accuracy and Coverage Evaluation: Documentation for the Sample Summary File and Sample Design File."* The layout is given again in Appendix C.

a. Create the file ACE_SDFV1_<mmddyy>.<SA> where <SA> is the state abbreviation (i.e AL, AK, AZ, etc.) for the state being sampled and <mmddyy> is the date of sample selection.

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b. Create a record for each first-step sampled block cluster. Put the following fields on the file:

Variable Description	Name
Census Region	REGION
Census Division	DIV
State code (FIPS)	STATE
County Code (FIPS)	COUNTY
Interim Tract (Pseudo-Tract)	ITRACT
ACE Block Cluster Number	CLUST
ACE Block Cluster Check Digit	DIGIT
Geography Block Cluster Number	GCLUST
TEA Group	TEAG
Sampling Stratum	SS
Demographic/Tenure Group Code	DTCODE
Demographic/Tenure Group Label	DTLABEL
Number of Housing Units for Sample Des.	NHU
Number of 2000 MAF Housing Units	NHUM
Number of 1990 Estimated Housing Units	NHU90
First-Step Index Number	INDEX1
Estimated Urbanicity of Block Cluster	ECLUSURB
American Indian Country Indicator	AICIND
Size Category	SIZCAT
Current Sample Indicator	CSI
Initial Block Cluster Sampling Indicator	BC1
Random Start for Initial Block Cluster Sampling	RS1
Take-Every for Initial Block Cluster Sampling	TE1

c. For each record, set BC1 equal to '1' to indicate that the block cluster was sampled during the first step.

d. For each record, set CSI equal to '1' to indicate the block cluster is currently in sample.

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C. CALCULATE ESTIMATED WORKLOADS FOR SAMPLING STRATA

For each sampling strata, calculate the estimated listing workload (INMHUL) by summing the number of housing units of the sampled block clusters in each strata.

$$INMHUL = \sum_{i=1}^{n} NHU_i$$

where n is the number of block clusters in sample in the stratum and NHU_i is the number of housing units in the block cluster.

Update the INMHUL for each sampling stratum on the Block Cluster Sampling Parameter File.

D. SECOND-STEP BLOCK CLUSTER SAMPLING DETERMINATION

The second-step block cluster sampling will be done when the state's estimated listing workload in the medium and large sampling strata (NHUL1_ML) is greater than 110 percent of the budgeted listing workload (BLIST). Otherwise, the second-step sampling is not needed.

Obtain the budgeted listing workload for each state from the 2000_TB.FIN file. The budgeted listing workload for each state is listed in Appendix I.

Determine the state's estimated listing workload in the medium and large sampling strata. as follows:

$$NHUL1\_ML = \sum_{i \,\in\, Medium,\, Large} INMHUL_i$$

where i is the sampling stratum.

The second-step block cluster sampling will be needed if the Listing Workload Ratio is greater than or equal to 0.10:

$$\frac{NHUL1\_ML - BLIST}{BLIST} \geq 0.10$$

For documentation purposes, the total state estimated listing workload after first-step sampling will be calculated. This is the sum across all of the sampling strata.

$$NHUL1 = \sum_{i=1}^{4} INMHUL_i$$

Using the Sample Summary File, assign the State Estimated HUs In Sample to list After First-Step Sampling (NHUL1) and the Estimated HUs In Sample To List In Medium And Large Strata After First-Step Sampling (NHUL1_ML) to the state record being sampled.

If second-step block cluster sampling is deemed necessary, then continue the process by going to section V.B. If second-step block cluster sampling is not needed, then go to section VI.C.

E.   DETERMINE WHICH SAMPLING TO DO SECOND STEP

Since a second-step sampling is necessary in the state, the next step is to identify in which sampling strata this operation will be done. The small and AIR strata are exempt from this step of sampling. Ideally, the second-step sampling would be limited to the large sampling stratum. However, if the second-step sampling rate is too low, then this causes differential weighting and sample size concerns. In which case, the second step will be done in both the medium and large sampling strata.

In order to determine which sampling strata to do the second step, perform the following calculation and analysis:

Calculate Check1, C1.

$$C1 = \frac{INMHUM_{Large}}{BLIST - INMHUM_{Medium}}$$

C1 is the second-step TE when only doing this step of sampling in the large stratum. If the product of the first and second-step TEs in the large stratum is greater than the medium TE, then we want to do the second step in both the medium and large strata.

Calculate the critical value as the ratio of the first-step TEs for the medium and large strata.

$$C = \frac{TE1_{medium}}{TE1_{large}}$$

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If Cl is less than or equal to C then do the second step in the large stratum only; otherwise, do the second step in both medium and large strata. In other words, subsampling in the large stratum only will not be done when the overall sampling rate after both the first and second steps of sampling for the large stratum is less than for medium.

VI   Second-Step Block Cluster Sampling

A.   OVERVIEW

The purpose of the second step is to subsample the first-step sampled block clusters if the first-step results in an unusually high amount of housing units to list.

The second step occurs only if the expected number of housing units in the medium and large strata is at least ten percent larger than the number of housing units budgeted for listing. The second-step sampling process will be similar to the first step. The first-step sampled block clusters will be sorted by the original order of selection. A second-step index number will be attached to each block cluster to identify the block clusters selected during the systematic sampling. The Sample Design File, Block Cluster Sampling Parameter File and the Universe File will be updated to reflect the second-step sampling.

For a state needing the second step, subsampling strata determined by the check in Section V.B. will be processed using the specifications in Section VI..B. Non-subsampling strata will be processed using the specifications in Section VI.C.

If the estimated number of housing units is not ten percent larger than the number of housing units budgeted for listing then all first-step sampled block clusters will remain in sample. Since no strata are being subsampled, all strata in the state will be processed using the specifications in Section VI.C.

B.   SECOND-STEP SAMPLING STRATA

Based on the check in section V.A., a state with over ten percent of the budget listing workload will be subsampled. The check in section V.B., indicates which strata will have second-step sampling.

1.   Calculate the Second-Step Take-Every, TE2:

If doing the second-step sampling only in the large stratum, then

$$TE2 = \frac{INMHUM_{Large}}{BLIST - INMHUM_{Medium}}$$

If doing the second-step sampling in both the medium and large strata, then

$$TE2 = \frac{NHUL1\_ML}{BLIST}$$

for both the medium and large strata.

2. Select the Sample:

Do the second-step sampling separately in each stratum as follows:

a. On the Block Cluster Sampling Parameter File, set the Indicator for Second Step of Block Cluster Sampling (I2) equal to '1' for the sampling stratum. This indicates that the second step is needed in this stratum.

b. Sort the block clusters selected in the first step by First-Step Index Number (INDEX1).

c. Number the first-step sampled block clusters consecutively from 1 to M. (This number is referred to as the Second-Step Index Number of the block cluster)

d. Select a systematic sample of block clusters as follows:

 • Generate a random number (RN2) between 0 and 1 ($0 < RN2 \leq 1$).

 • Calculate the Second-Step Random Start, $RS2 = RN2 \times TE2$.

 • Generate a sequence of numbers $L_1,...,L_m$ as follows:

 • Let $L_1 = RS2$

 • Calculate $L_j = L_{j-1} + TE2$, for $j = 2$ to m where m is the largest integer such that $[RS2 + (m-1) \times TE2] <= M$

 • Round each L_j up to the nearest integer (an integer round to itself).

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e. Compute a Check

Check the number of selected second-step block clusters by calculating c, which is a check of the sampling procedures:

$$c = \left| \frac{M}{TE2} - m \right|$$

If the sampling is implemented correctly, c will be less than 1. For values of c that are not less than one and have not been resolved, contact the DSSD for review of the sampling operations.

If the sampling is not implemented correctly, do not proceed with the remaining steps in this part until it is resolved.

f. Each block cluster with a Second-Step Index Number equal to the rounded values of L_j, $j = 1,...,m$, are the selected second-step sample block clusters. Do the following for each second-step sampled block cluster:

i. Use the Sample Design File and find the block cluster record.

- Assign the Second-Step Block Clustering Sampling Indicator (BC2) equal to '1'. This indicates that the block cluster was selected in the second step.

- Assign the Second-Step Index Number (INDEX2).

- Assign the Random Start for Second-Step Block Cluster Sampling (RS2).

- Assign the Take-Every for Second-Step Block Cluster Sampling (TE2).

- Calculate the unbiased weight after block cluster sampling (WEIGHTBC):

$$WEIGHTBC = TE1 \times TE2$$

Assign the unbiased weight after block cluster sampling (WEIGHTBC) to the file.

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ii.   Use the Universe File and find the block cluster record.

- ▸   Assign the Second-Step Block Clustering Sampling Indicator (BC2) equal to '1'. This indicates that the block cluster was selected in the second step.

- ▸   Put the Second-Step Index Number (INDEX2) on the Universe File.

g.   If the Second-Step Index Number of the block cluster does NOT match one of the rounded values of L_j, j = 1,...,m, then the block cluster is no longer in the sample. Do the following for each of these block clusters:

i.   Use the State Sample Design File and find the block cluster record.

- ▸   Assign the Second-Step Block Clustering Sampling Indicator (BC2) equal to '0'. This indicates that the block cluster was NOT selected in the second step.

- ▸   Change the Current Sample Indicator (CSI) equal to '0'. The cluster is no longer in sample.

- ▸   Put the Second-Step Index Number (INDEX2) on the file.

- ▸   Put the Random Start for Second-Step Block Cluster Sampling (RS2) on the file

- ▸   Put the Take-Every for Second-Step Block Cluster Sampling (TE2) on the file

- ▸   Assign the Unbiased Weight After Block Cluster Sampling (WEIGHTBC) a value of '   ' (12 blanks). This block cluster was not selected.

ii.   Use the Universe File and find the block cluster record.

- ▸   Assign the Second-Step Block Clustering Sampling Indicator (BC2) equal to '0'. This indicates that the block cluster was NOT selected in the second step.

- ▸   Change the Current Sample Indicator (CSI) equal to '0'. The cluster is no longer in sample.

▶ Put the Second-Step Index Number (INDEX2) on the Universe File.

h. Make the following updates for block clusters not selected in the first-step on the Universe File. These records have First-Step Block Cluster Sampling Indicator (BC1) set equal to '0'. This step is to maintain clear documentation of the Universe File for future sample selections.

    i. Assign the Second-Step Block Cluster Sampling Indicator (BC2) equal to '0'. This indicates the cluster is not in sample.

    ii. Set the Second-Step Index Number (INDEX2) equal to '   ' (five blanks). The clusters were not involved in the subsampling.

i. Count the number of second-step sampled clusters in the sampling stratum.

Assign this count to the Clusters In Sample To List (CLUSL) field for the sampling stratum on the Block Cluster Sampling Parameter File.

j. Count the number of housing units to be listed for the second step sample clusters in the sampling stratum.

Assign this count to the Housing Units In Sample To List (NMHUL) for the sampling stratum on the Block Cluster Sampling Parameter File.

k. Update the Random Start for Second-Step Block Cluster Sampling (RS2) field and the Second-Step Take-Every (TE2) field for the sampling stratum on the Block Cluster Sampling Parameter File.

C. NO SECOND STEP NEEDED IN STRATUM

For state where the second-step process is not required, all first-step sampled clusters in all of the strata remain in sample. These states go through the following process. For states where subsampling occurs, the strata not involved in subsampling go through the following process.

1. Make the following updates to the Block Cluster Sampling Parameter File for each of the sampling strata not needing the second-step sampling:

a. Assign Take-Every for Second-Step Block Cluster Sampling (TE2) equal to 1.000000.

b. Assign Random Start for Second-Step Block Cluster Sampling (RS2) equal to 1.000000.

c. Assign Indicator for Second Step of Block Cluster Sampling (I2) equal to '0'. The second step was NOT needed in these sampling strata.

d. Set the Clusters in Sample to List (CLUSL) equal to the Initial Clusters in Sample to List (ICLUSL).

e. Set the Housing Units in Sample to List (NMHUL) equal to the Initial Housing Units in Sample to List (INMHUL).

2. Make the following updates for all records in each sampling strata not involved in second-step subsampling on the Sample Design File:

a. Assign the Second-Step Block Cluster Sampling Indicator (BC2) equal to '1'. This indicates that the block cluster was retained in the sample.

b. Set the Second-Step Index Number (INDEX2) equal to ' ' (5 blanks). Second-Step Index Numbers are only assigned if subsampling in the stratum is necessary.

c. Assign Take-Every for Second-Step Block Cluster Sampling (TE2) equal to 1.000000.

d. Assign Random Start for Second-Step Block Cluster Sampling (RS2) equal to 1.000000.

e. The Unbiased Weight after Block Cluster Sampling (WEIGHTBC) is equal to the First-Step Take-Every (TE1).

$$WEIGHTBC = TE1$$

Assign the Unbiased Weight after Block Cluster Sampling (WEIGHTBC) to the file.

3. Make the following updates for first-step sampled block clusters not involved in second-step subsampling on the Universe File. These records have First-Step Block Cluster Sampling Indicator (BC1) set equal to '1'.

a. Assign the Second-Step Block Cluster Sampling Indicator (BC2) equal to '1'. This indicates the cluster is still in sample.

b.   Set the Second-Step Index Number (INDEX2) equal to '   ' (five blanks). Second-Step Index Numbers are only assigned if subsampling in the stratum is necessary.

4.   Make the following updates for first-step non-sampled clusters in the state on the Universe File. These records have First-Step Block Cluster Sampling Indicator (BC1) set equal to '0'.

a.   Assign the Second-Step Block Cluster Sampling Indicator (BC2) equal to '0'. This indicates the cluster is not in sample.

b.   Set the Second-Step Index Number (INDEX2) equal to '   ' (five blanks). Second-Step Index Numbers are only assigned if subsampling in the stratum is necessary.

VII.   OUTPUT

A.   ACE STRATIFICATION SUMMARY FILE

After the listing of HUs in each cluster, cluster reduction will be done to reach the ACE sample size. The ACE Stratification Summary File will provide the information for developing this reduction. This file will have a record for each demographic/tenure group code (DTCODE) in every sampling stratum in the state. The file will provide the estimated number of sampled housing units and demographic/tenure people by summing over the sampled block clusters. The layout of the file is in Appendix D.

For each demographic/tenure group code, count the following:

1.   HUs (NHU)
2.   Black/Owner People
3.   Black/Renter People
4.   Hispanic/Owner People
5.   Hispanic/Renter People
6.   Asian/Owner People
7.   Asian/Renter People
8.   Hawaiian and Pacific Islander/Owner People
9.   Hawaiian and Pacific Islander/Renter People
10.   American Indian Reservation /Owner People
11.   American Indian Reservation/Renter People
12.   American Indian Not On Reservation/Owner People
13.   American Indian Not On Reservation/Renter People
14.   White and Other/Owner People
15.   White and Other/Renter People

Note: Use the people population counts from the Universe File

B. ACE SAMPLE CLUSTER FILE

After sampling, the block Type of Enumeration Area (TEA), cluster TEA and Local Census Office will need to be updated. The block TEA and cluster TEA may have changed since clustering. The Local Census Office boundaries were not available when clustering began. The DSCMO will create the ACE Sample Cluster File that will be sent to the GEO. For all block clusters that remain in sample after the second step, there will be one record for each block in the cluster. The layout is in Appendix E. The GEO will use this file to create the ACE GRF.

Create the ACE Sample Cluster File with the following variables for each block:

Variable Description	Name
State	STATE
Local Census Office	LCO
County	COUNTY
Tract	ITRACT
ACE Cluster Number	CLUST
Check Digit	DIGIT
Sampling Strata	SS
Demographic/Tenure Group Code	DTCODE
2000 Collection Block	BK2K
Geography Cluster Number	GCLUST
Cluster Size Recode from Geography	GSIZE
Number of Housing Unit in Cluster	NHU
Number of Housing Units in Block	NHB
Number of 2000 MAF Housing Units in Block	NHUMB
Number of 1990 Estimated Housing Units in Block	NHU90B
Total Persons in the Cluster	NP

C. ACCESS TO FILES FOR REVIEW

The sampling process can be reviewed if access is provided to the Sample Design File, the Block Cluster Sampling Parameter File, the Universe File and the ACE Sample Cluster File from our DMBA01 Alpha machine. Notify the DSSD Sample Design staff when the files are available and where they are located.

VIII. UPDATE SAMPLE DESIGN FILE AND CREATE FIELD PRIORITIZATION FILE

The DSCMO will use the ACE GRFs to update the Sample Design File. After the file is received from the GEO, the Local Census Office and Type of Enumeration Area Recode will need to be assigned on the Sample Design File. A Prioritization file will be created for Field Division. This will allow them to prioritize their HUFU and PFU workloads prior to the processing operation.

A. UPDATE SAMPLE DESIGN FILE

After the operational GRF is received from the GEO, updates will need to be made to the Sample Design File. The Local Census Office and the Type of Enumeration Area Recode will be assigned.

On the Sample Design File, update the following variables for all block clusters that remain in sample:

Variable Description	Name
Local Census Office	LCO
Type of Enumeration Area Recode	TEACR
1 = City-Style Address	
2 = Non-City-Style Address	

After all states have been verified, concatenate the 52 separate state Sample Design Files into one file, ACE2000_SDFV1.<mmddyy> .

B. FIELD PRIORITIZATION FILE

After the GEO updates the TEA and Local Census Office information and returns the file to the DSCMO, a file of the block clusters remaining in sample will be created for Field Division. This will be a block cluster level file and contain all block clusters that remain in sample from the 50 states, the District of Columbia and Puerto Rico. The layout of the file is in Appendix G.

Output the following variables for each block cluster that remains in sample on the file:

Variable Description	Name
Regional Office	RO
Local Census Office	LCO
ACE Cluster Number	CLUST
Type of Enumeration Area Recode	TEACR
1 = City-Style Address	
2 = Non-City-Style Address	

cc: DSSD Census 2000 Procedures and Operations Memorandum Series Distribution List
        ACE Implementation Team/Statistical Design Team Leaders List
        DSSD Sample Design Team
        S. Odell (DSSD)
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        R. Ruiz (GEO)
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        S. Hawala (PRED)

Block Cluster Sampling Parameter File Layout

Variable Description	Name	Places
Census Region	REGION	1
Census Division	DIV	2
State code (01-72 = FIPS State Code)	STATE	3-4
Sampling Stratum	SS	5
Target number of block clusters	TCLUST	7-14
Total number of block clusters	NCLUST	16-23
Total number of housing units	NHU	25-32
First stage Take-Every	TE1	34-44
First stage Random Start	RS1	46-56
Indicator for Second-Step of Block Cluster Sampling	I2	58-58
Second-Step Random Start	RS2	60-70
Second-Step Take-Every	TE2	72-82
Clusters in Sample to List	CLUSL	84-91
Housing Units in Sample to List After First Step	INMHUL	93-100
Housing Units in Sample to List After Second Step	NMHUL	102-109

Universe File Layout

Variable Description	Name	Places
State	STATE	1-2
County	COUNTY	3-5
Interim Tract (a.k.a. pseudo-tract)	ITRACT	6-11
Block Number	COLBLOCK	12-16
Blank		17-17
Cluster Number (geography not ACE)	GCLUS	18-22
Blank		23-23
Cluster Size code	CLUSSIZE	24-24

       1 = Clusters with 0 HUs
       2 = Clusters with 1 HUs
       3 = Clusters with 2 HUs
       4 = Clusters with between 3 and 5 HUs
       5 = Clusters with between 6 and 9 HUs
       6 = Clusters with between 10 and 19 HUs
       7 = Clusters with between 20 and 29 HUs
       8 = Clusters with between 30 and 79 HUs
       9 = Clusters with 80 or more HUs

Variable Description	Name	Places
Blank		25-25
Block Area (Sq. Miles)	BAREA	26-33
Blank		34-34
Block Perimeter (Miles)	BPERIM	35-40
Blank		41-41
Block Cluster Area (Sq. Miles)	BCAREA	42-49
Blank		50-50
Block Cluster Perimeter (Miles)	BCPERIM	51-56
Number of HUs in cluster	NHU	57-61
Number of HUs in block	NHUBLOCK	62-66
Block TEA	TEA	67-67

       1 = Mailout/Mailback
       2 = Update/Leave
       3 = List/Enumerate
       5 = Rural Update/Enumerate
       6 = Military
       7 = Urban Update/Leave
       8 = Update/Leave to Mailout/Mailback conversions
       9 = Mailout/Mailback to Update/Leave conversions

TEA Group for Block Cluster TEABC 68-68
    A= Mailout/Mailback or
        Urban Update/Leave or
        Update/Leave to Mailout/Mailback conversions
    B= Update/Leave or
        Rural Update/Enumerate
    C=List/Enumerate
    D=Military
    E=Mailout/Mailback to Update/Leave conversions

2000 MAF HUs count NHUM 69-73
    ' ' Blank if no HU count available

1990 ACF HUs count NHU90 74-78
    ' ' Blank if no HUs count available

Housing Unit Count Indicator HUIND 79-79
    1 = from 2000 MAF
    2 = from 1990 ACF

Invisible Boundary Collapse Indicator INV 80-80
    0 = No
    1 = Yes (Collapsing across Invisible Boundary in BC)

American Indian Country Indicator AICIND 81-81
    0 = No American Indian Country
    1 = American Indian Reservation/trust land
    2 = Tribal jurisdiction statistical area/
        Alaska Native Village statistical area/
        tribal designated statistical area

Military Indicator MILIND 82-82
    0 = No Military Area
    1 = Block contains Military Area

Collapsed Enclosed Block Indicator CEBI 83-83
    0 = Otherwise
    1 = An enclosed block has been forced to collapse

Blank 84-90

2000 Collection Block Estimated Number of:

Hawaiian and Pacific Islander Renter	ECOLPIR	91-95
Hawaiian and Pacific Islander Owner	ECOLPIO	96-100
American Indian and Alaska Native Renter	ECOLIR	101-105
American Indian and Alaska Native Owner	ECOLIO	106-110
Asian Renter	ECOLAR	111-115
Asian Owner	ECOLAO	116-120
Hispanic Renter	ECOLHR	121-125
Hispanic Owner	ECOLHO	126-130
Black Renter	ECOLBR	131-135
Black Owner	ECOLBO	136-140
White and Other Renter	ECOLOR	141-145
White and Other Owner	ECOLOO	146-150
Total Renters	ECOLR	151-155
Total Owners	ECOLO	156-160
Total Housing Units	ECOLHU	161-165
Occupied Housing Units	ECOLOHU	166-170
Total People (Non-GQ)	ECOLPOP	171-175

Estimated 1990 urbanicity of the 2000 collection block	ECOLURB	176-176

1 = Urban Area with 1990 population ≥ 250,000
2 = Other Urban Area
3 = Non-Urban Area

Blank	177-180

2000 Collection Block Cluster Estimated Number of:

Hawaiian and Pacific Islander Renter	ECLUSPIR	181-185
Hawaiian and Pacific Islander Owner	ECLUSPIO	186-190
American Indian and Alaska Native Renter	ECLUSIR	191-195
American Indian and Alaska Native Owner	ECLUSIO	196-200
Asian Renter	ECLUSAR	201-205
Asian Owner	ECLUSAO	206-210
Hispanic Renter	ECLUSHR	211-215
Hispanic Owner	ECLUSHO	216-220
Black Renter	ECLUSBR	221-225
Black Owner	ECLUSBO	226-230
White and Other Renter	ECLUSOR	231-235
White and Other Owner	ECLUSOO	236-240
Total Renters	ECLUSR	241-245
Total Owners	ECLUSO	246-250
Total Housing Units	ECLUSHU	251-255
Occupied Housing Units	ECLUSOHU	256-260
Total People (Non-GQ)	ECLUSPOP	261-265
Blank		266-275

Estimated 1990 urbanicity of 2000 block cluster	ECLUSURB	276-276
1 = Urban Area with 1990 population ≥ 250,000		
2 = Other Urban Area		
3 = Non-Urban Area		
Size Category	SIZECAT	277-277
1 = Small (0-2 HUs)		
2 = Medium (3-79 HUs)		
3 = Large (80+ HUs)		
Number of sampling strata in state	NSSINST	278-278
Sample stratum	SS	279-279
1 = Small		
2 = Medium (non-AIR)		
3 = Large (non-AIR)		
4 = American Indian Reservation		
Blank		280-285
2000 Collection Block Cluster Proportion of Population that is:		
Hawaiian and Pacific Islander Renter	CLUPPIR	286-290
Hawaiian and Pacific Islander Owner	CLUPPIO	291-295
American Indian and Alaska Native Renter	CLUPIR	296-300
American Indian and Alaska Native Owner	CLUPIO	301-305
Asian Renter	CLUPAR	306-310
Asian Owner	CLUPAO	311-315
Hispanic Renter	CLUPHR	316-320
Hispanic Owner	CLUPHO	321-325
Black Renter	CLUPBR	326-330
Black Owner	CLUPBO	331-335
White and Other Renter	CLUPOR	336-340
White and Other Owner	CLUPOO	341-345
Renters	CLUPR	346-350
Owners	CLUPO	351-355
Blank		356-364
Demographic/Tenure group (code)	DTCODE	365-366
Demographic/Tenure group (label)	DTLABEL	367-368
Region	REGION	369-369
Division	DIV	370-370
Blank		371-399

Current Sample Indicator	CSI	400-400
0 = Not in Sample		
1 = In Sample		
First-Step Block Cluster Sample Indicator	BC1	402-402
First-Step Index Number	INDEX1	404-411
Second-Step Block Cluster Sample Indicator	BC2	413-413
Second-Step Index Number	INDEX2	415-422

Sample Design File Layout

Variable Description	Name	Places
Census Region	REGION	1
Census Division	DIV	2
State code	STATE	3-4
County code	COUNTY	5-7
Local census office	LCO	8-11
Interim Tract (Pseudo Tract)	ITRACT	12-17
Current Sample Indicator	CSI	19
ACE block cluster number	CLUST	21-25
Check Digit	DIGIT	26
Geography block cluster number	GCLUST	28-32
Type of Enumeration Area Recode	TEACR	34
Type of Enumeration Area group	TEAG	36
Number of HUs used for sample design	NHU	37-41
Number of MAF HUs	NHUM	43-47
Number of 1990 HUs	NHU90	49-53
Sampling Stratum	SS	55

        1 = Small
        2 = Medium
        3 = Large
        4 = American Indian Reservation

American Indian Country Indicator	AICIND	56

        0 = No American Indian Country
        1 = American Indian Reservation/trust land
        2 = Tribal Jurisdiction Area/
            Alaska Native Village Statistical Area/
            Tribal Designated Statistical Area

Demographic/Tenure Group code	DTCODE	57-58
Demographic/Tenure Group label	DTLABEL	59-60
Estimated Urbanicity of block cluster	ECLUSURB	62

        1 = Urban Area with population $\geq 250,000$
        2 = Other Urban Area
        3 = Non-Urban Area

Size Category	SIZCAT	63

        1=Small (0-2 hus)
        2=Medium (3-79 hus)
        3=Large (80+ hus)

Additional space		64-91

First step index number	INDEX1	92-99
Initial block cluster sampling Indicator	BC1	101
1 = Selected		
Random Start for initial block cluster sampling	RS1	103-113
Take-every for initial block cluster sampling	TE1	115-125
Second block cluster sampling Indicator	BC2	127
0 = Not Selected, 1 = Selected		
Random Start for second block cluster sampling	RS2	129-139
Take-every for second block cluster sampling	TE2	141-151
Unbiased weight after block cluster sampling	WEIGHTBC	153-164

ACE Summary File Layout

There will be one file for each state. This file will have one record per implicit stratum in each sampling stratum.

Variable Description	Name	Location
FIPS State Code	STATE	1:2
Sampling Stratum	SS	4:4
1 = Small Block Clusters,		
2 = Medium Block Clusters,		
3 = Large Block Clusters,		
4 = American Indian Reservation (AIR) Block Clusters		
Demographic/Tenure Group Code	DTCODE	6:7
Number of Block Clusters	S_NCLUST	10:17
Number of Housing Units	S_NHU	20:27
Number of Black/Owner People in 1990	S_BOP	30:37
Number of Black/Renter People in 1990	S_BR	40:47
Number of Hispanic/Owner People in 1990	S_HOP	50:57
Number of Hispanic/Renter People in 1990	S_HRP	60:67
Number of Asian/Owner People in 1990	S_AOP	70:77
Number of Asian/Renter People in 1990	S_ARP	80:87
Number of Hawaiian and Pacific Islander/Owner People in 1990	S_POP	90:97
Number of Hawaiian and Pacific Islander/Renter People in 1990	S_PR	100:107
Number of American Indian Reservation/Owner People in 1990	S_AIROP	110:117
Number of American Indian Reservation/Renter People in 1990	S_AIRRP	120:127
Number of American Indian Not on Reservation/Owner People in 1990	S_AICOP	130:137
Number of American Indian Not on Reservation/Renter People in 1990	S_AICRP	140:147
Number of White and Other/Owner People in 1990	S_OOP	150:157
Number of White and Other/Renter People in 1990	S_ORP	160:167

ACE Sample Cluster File Layout

Variable Description	Name	Location
FIPS State Code	STATE	1:2
Local Census Office	LCO	4:7
(To be filled by the GEO)		
FIPS County Code	COUNTY	9:11
ACE Cluster Number	CLUST	13:17
Check Digit	DIGIT	18:18
Sampling Strata	SS	20:20
1 = Small Block Clusters,		
2 = Medium Block Clusters,		
3 = Large Block Clusters,		
4 = American Indian Reservation (AIR) Block Clusters		
Demographic/Tenure Group Code	DTCODE	21:21
2000 Collection Block	BK2K	23:27
Geography Cluster Number from Geography	GCLUST	29:33
Cluster Size Recode from Geography	GSIZE	36:36
Number of Housing Unit in Cluster	NHU	38:42
Number of Housing Units in Block	NHB	44:48
Number of 2000 MAF Housing Units in Block	NHUMB	50:54
Number of 1990 Estimated Housing Units in Block	NHU90B	56:60
Block Type of Enumeration Area Revised	TEABR	62:62
(To be filled by the GEO)		
Type of Enumeration Area Recode	TEACR	64:64
(To be filled by the GEO)		
1 = City-Style Address		
2 = Non-City-Style Address		
Total Persons in the Cluster	NP	66:73

Sample Summary File Layout

Variable Description	Name	Places
Census Region	REGION	1
Census Division	DIV	2
State code (01-72 = FIPS State Code)	STATE	3-4
Number of HUs budgeted for listing in med. and lg. clusters	BLIST	6-13
Target number of clusters in med. and lg. sampling strata	TCLUST	15-18
Target number of clusters in small sampling strata	TCLUST	20-22
Target number of clusters in AIR sampling strata	TCLUST	24-26
Total number of block clusters	NCLUST	28-35
Total number of HUs	NHU	37-44
Expected clusters in sample to list	ECLUST	46-49
Expected HUs in sample to list	EXPHUL	51-58
Additional space		59-80

Variable Description	Name	Places
Clusters in sample to list after 1st step sampling	NCLUSTL1	81-85
Estimated HUs in sample to list after 1st step sampling	NHUL1	87-94
Estimated HUs in sample to list after 1st step sampling in Med & Lg clusters	NHUL1_ML	96-103
Indicator for second step of block cluster sampling 1 = Second step needed, 2 = Second step not needed	I2	105
Clusters in sample to list after 2nd step sampling	NCLUSTL2	107-111
Estimated HUs in sample to list after 2nd step sampling	NHUL2	113-120
Estimated HUs in sample to list after 2nd step sampling in Med & Lg clusters	NHUL2_ML	122-129

Field Prioritization File Layout

Variable Description	Name	Position
Regional Office	RO	1:2
Local Census Office	LCO	4:7
ACE Cluster Number	CLUST	9:13
Number of Hus for Sample Design	DIGIT	14:14
Number of HUs for Sample Design.	NHU	16:23
TEA Revised Code	TEACR	25:25

      1 = City-Style Address
      2 = Non-City-Style Address

Sample Size Input File Layout

Variable Description	Name	Places
Census Region	REGION	1
Census Division	DIV	2
State	STATE	3-4
Number of housing units budgeted for listing	BLIST	6-13
Target Clusters for small clusters	TCLUSTS	15-17
Target Clusters for medium and large clusters	TCLUST	19-22
Target Clusters for AIR	TCLUST	24-26
Number of sampling stratum in state	NSSINST	28
First ACE block cluster number	CSTART	30-34

State Budgeted Number of Housing Units for Listing and
First-Step Target Block Cluster Sample Sizes

State	Region	Division	Number of Strata	Budgeted Listing	AIR Cluster Target	Small Cluster Target	Medium and Large Cluster Target
Alabama*	3	6	3	25,347	0	116	417
Alaska	4	9	4	27,196	1	20	334
Arizona	4	8	4	48,451	110	86	492
Arkansas	3	7	3	24,744	0	90	494
California	4	9	4	284,076	14	184	2,753
Colorado	4	8	4	37,965	2	83	479
Connecticut*	1	1	3	30,039	0	20	377
Delaware	3	5	3	21,610	0	20	413
DC	3	5	3	53,369	0	20	384
Florida	3	5	4	62,845	1	145	520
Georgia*	3	5	3	37,384	0	154	399
Hawaii	4	9	3	45,059	0	20	300
Idaho	4	8	4	19,157	6	54	412
Illinois	2	3	3	31,571	0	185	430
Indiana	2	3	3	15,925	0	140	275
Iowa*	2	4	3	14,108	0	147	300
Kansas	2	4	4	16,281	1	193	300
Kentucky	3	6	3	29,621	0	96	447
Louisiana*	3	7	3	37,378	0	65	595
Maine	1	1	4	16,572	1	38	309
Maryland	3	5	3	41,107	0	36	368
Massachusetts*	1	1	3	27,255	0	38	375
Michigan	2	3	4	24,128	5	122	379
Minnesota	2	4	4	19,091	10	141	300
Mississippi	3	6	4	19,990	3	81	402
Missouri	2	4	3	19,807	0	162	300
Montana	4	8	4	17,969	24	67	420
Nebraska	2	4	4	14,177	3	142	300
Nevada	4	8	4	63,031	5	46	468
New Hampshire	1	1	3	21,128	0	25	307
New Jersey**	1	2	3	37,394	0	39	461
New Mexico	4	8	4	32,242	70	108	481
New York	1	2	4	143,949	5	143	1,261
North Carolina	3	5	4	26,717	4	143	400
North Dakota	2	4	4	15,738	12	121	300
Ohio	2	3	3	30,790	0	132	421

State	Region	Division	Number of Strata	Budgeted Listing	AIR Cluster Target	Small Cluster Target	Medium and Large Cluster Target
Oklahoma	3	7	4	25,328	8	142	426
Oregon	4	9	4	20,577	3	86	320
Pennsylvania	1	2	3	34,920	0	180	585
Rhode Island*	1	1	3	23,557	0	20	373
South Carolina*	3	5	3	26,709	0	95	422
South Dakota	2	4	4	14,227	27	106	300
Tennessee	3	6	3	30,255	0	133	433
Texas	3	7	4	176,234	1	349	1,945
Utah	4	8	4	32,777	7	38	478
Vermont	1	1	3	17,009	0	21	300
Virginia*	3	5	3	37,114	0	98	371
Washington	4	9	4	26,832	17	73	332
West Virginia	3	5	3	17,557	0	46	300
Wisconsin	2	3	4	14,470	10	119	275
Wyoming	4	8	4	18,293	5	72	418
United States				1,949,070	355	5000	24,601
Puerto Rico	0***	0***	3	46,700	0	96	480

* States contain AIR population, but not AIR sampling stratum. AIR people will be given a chance of selection in the general state sample.
** New Jersey AIR reservations had no population in 1990.
*** Puerto Rico is an outlying area. Because of this it has no region or division code. Therefore, we assign the code 0.

ACE Block Cluster Number Allocation

Division	State	ACE Block Cluster Number
New England	Connecticut	11001-11999
	Maine	12001-12999
	Massachusetts	13001-13999
	New Hampshire	14001-14999
	Rhode Island	15001-15999
	Vermont	16001-16999
	Puerto Rico	17001-17999
Mid-Atlantic	New Jersey	21001-21999
	New York	22001-24999
	Pennsylvania	25001-25999
South Atlantic	Delaware	31001-31999
	DC	32001-32999
	Florida	33001-33999
	Georgia	34001-34999
	Maryland	35001-35999
	North Carolina	36001-36999
	South Carolina	37001-37999
	Virginia	38001-38999
	West Virginia	39001-39999
East South Central	Alabama	41001-41999
	Kentucky	42001-42999
	Mississippi	43001-43999
	Tennessee	44001-44999
West South Central	Arkansas	51001-51999
	Louisiana	52001-52999
	Oklahoma	53001-53999
	Texas	54001-57999
East North Central	Illinois	61001-61999
	Indiana	62001-62999
	Michigan	63001-63999
	Ohio	64001-64999
	Wisconsin	65001-65999

Division	State	ACE Block Cluster Number
West North Central	Iowa	71001-71999
	Kansas	72001-72999
	Minnesota	73001-73999
	Missouri	74001-74999
	Nebraska	75001-75999
	North Dakota	76001-76999
	South Dakota	77001-77999
Mountain	Arizona	81001-81999
	Colorado	82001-82999
	Idaho	83001-83999
	Montana	84001-84999
	Nevada	85001-85999
	New Mexico	86001-86999
	Utah	87001-87999
	Wyoming	88001-88999
Pacific	Alaska	91001-91999
	California	92001-96999
	Hawaii	97001-97999
	Oregon	98001-98999
	Washington	99001-99999

Double-Add-Double Check-digit Algorithm

1. Set working count (WC) to 0.

2. Set working data (WD) to the binary value of the input string

3. Look at the rightmost digit of WD
   (i.e. start with the units digit which is MOD(WD,10)) if its 0 add 0 to WC
   if its 1 add 2 to WC
   if its 2 add 4 to WC
   if its 3 add 6 to WC
   if its 4 add 8 to WC
   if its 5 add 1 to WC
   if its 6 add 3 to WC
   if its 7 add 5 to WC
   if its 8 add 7 to WC
   if its 9 add 9 to WC
   (the added value is 'double' the input - if the result is 10+, the tens digit and units digit are added)

4. Add the second rightmost digit of WD to WC
   (i.e. start with the tens digit which is MOD(WD/10,10))

5. Shift WD 2 digits to the right (i.e. WD = WD/100)

6. While WD is not zero, repeat from step 3.

7. set WC to MOD10 of WC

8. If WC is 1 to 9 then set the CHECKDIGIT to 10-WC.
   If WC is 0 then set the CHECKDIGIT to 0.

Example:

the CHECKDIGIT for 123456 is 6, because
WC = 'double'6 + 5 + 'double'4 + 3 + 'double'2 + 1 = 3 + 5 + 8 + 3 + 4 + 1 = 24 so the
CHECKDIGIT is 10-MOD(24,10) = 6.